GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Additive technologies, PG_00062734		
Field of study	Technologies for Industry 5.0		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mateusz Cieślik	
	Teachers	dr inż. Mateusz Cieślik	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	30.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	5.0	50.0	100

Subject objectives

The aim of the course "Additive Technologies" is to introduce students to the principles and methods of reverse engineering, design, and manufacturing of objects using various additive technologies, particularly 3D printing. The practical nature of the course involves engaging students in the process of producing composites modified with various nanomaterials and evaluating the effective properties of the materials.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] demonstrates knowledge on materials used in industrial technologies, their structure and fabrication, knows the principles of conducting research, analyzing it and creating technical documentation	The student has basic knowledge of the structure, manufacturing, and properties of materials, especially those used in additive technologies. The student knows the principles of conducting selected material tests and interpreting results, as well as creating technical documentation.	[SW1] Assessment of factual knowledge
[K6_U03] has the ability to plan, prepare and carry out engineering activities using practical knowledge and understanding of the specificity of materials, devices and tools, processes and technologies, and prepare a substantive report	The student can develop and carry out activities related to the application of selected additive technologies, using basic knowledge of these technologies. the student can prepare a substantive report.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_K02] makes decisions independently, carries out a critical assessment of own actions and actions of managed teams, is ready to make decisions and accept responsibility for the consequences of these actions	The student can face problems both independently and as part of a team, and take responsibility for the decisions made and their consequences.	[SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Lectures

1. **Definition of Additive Technologies**
   - Understanding what additive technologies are
   - Comparison with traditional manufacturing methods
   - Principles of 3D printing, laser processing, and milling
   - Advantages and limitations of each method
2. **3D Printing Methods and Materials**
   - Overview of different 3D printing technologies (FDM, SLA, SLS, etc.)
   - Types of materials used in 3D printing
   - Advantages and limitations of each technology and material
3. **Practical Applications of 3D Printing**
   - Industrial applications: manufacturing spare parts, prototyping
   - Medicine: printing implants, surgical tools
   - Fashion: creating unique clothing and accessories
   - Art: new artistic forms, personalized works
4. **Nanotechnology in 3D Printing**
   - Introduction to nanotechnology
   - Creating composites with nanomaterials
   - Surface modification using nanotechnology
5. **Material Properties**
   - Basic properties of materials used in 3D printing
   - Rheological properties, melting temperature, aggregation, etc.
   - How these properties affect the printing process and final product quality
6. **Preparing Files for 3D Printing**
   - Creating and preparing 3D models
   - Performance analysis of the project
   - Choosing the right printing parameters (layer thickness, printing speed, temperature, etc.)

Practical Project

Project Goal: Applying the acquired knowledge in practice by manufacturing and testing composite materials with nanomaterial additives that have specific functional properties.

Project Stages:

1. **Manufacturing Composite Materials**
   - Designing and printing composites with nanomaterial additives
   - Aiming to achieve specific functional properties (e.g., electrical conductivity, hydrophobicity, magnetic properties)
2. **Printing and Testing**
   - Conducting tests on printed materials
   - Modifying prints to add additional properties (e.g., roughness, surface functionalization)

Prerequisites and co-requisites

Knowledge in the basics of physics and engineering graphics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	60.0%	40.0%
Passing the lecture	60.0%	60.0%

Recommended reading

Basic literature	Nick Kloski, Druk 3D. Praktyczny przewodnik po sprzęcie, oprogramowaniu i usługach, Helion, 2022
Supplementary literature	Anna Kaziunas France, Świat druku 3D Przewodnik, Helion
eResources addresses	

Example issues/ example questions/ tasks being completed	1. Describe the difference between FDM and SLA in 3D printing. What are their advantages and disadvantages? Compare both methods in the context of prototyping. 2. Explain what G-code is and how it is used in 3D printing. Describe the basic G-code commands and how they affect the printing process. 3. Discuss the different types of materials used in 3D printing. Compare thermoplastics and thermosets in terms of their applications and properties. Give examples of products that can be printed using these materials.
Work placement	Not applicable

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